

In The Claims

Kindly cancel claim 3 without prejudice.

Please replace claims 1, 4, 22 and 24 as shown below. A marked up version of the amended claims is attached to this Amendment.

1. (Thrice Amended) A process for forming a lubricative film for cold working on a metal substrate, said process comprising the following operations:

(I) bringing said metal substrate into contact with an aqueous electrolyte solution comprising water and:

(A) at least 50 g/l of dissolved zinc cations;

(B) at least 20 g/l of dissolved phosphate anions; and

(C) at least one dissolved auxiliary acid other than phosphoric acid, said auxiliary acid having at least a first ionization constant that is greater than the third ionization constant for phosphoric acid; and, optionally, other constituents as detailed further below,

this aqueous electrolyte also being in contact with a counter-electrode that is not said metal substrate to be cold worked, so that an electric current can pass through the counter-electrode as anode, the aqueous electrolyte solution by ionic conduction, and said metal substrate as cathode;

(II) passing through said metal substrate while it remains in contact with said aqueous electrolyte solution an electric current that has a net cathodizing character at said metal substrate for a sufficient time to form an adherent solid phosphate conversion coating over said metal substrate;

(III) discontinuing contact between said aqueous electrolyte solution and said metal substrate bearing said adherent solid phosphate conversion coating; and

(IV) applying to the exterior surface of said solid phosphate conversion coating, when it is not in contact with said aqueous electrolyte solution, a water- or oil-based lubricant coating,

the aqueous electrolyte solution having a pH value at least as low as the pH value of a hypothetical reference electrolyte solution that contains the same actual amounts of dissolved zinc and phosphate ions as does said aqueous electrolyte solution and in addition contains at least 30 g/l of nitric acid as its only auxiliary acid;

at least one type of divalent or trivalent metal ions selected from a group consisting of magnesium, aluminum, manganese, chromium, iron, nickel, and copper; and

a concentration of calcium ions such that the molar ratio of calcium ions to zinc ions is from 0.1:1 to 2:1.

4. (Amended) The process according to claim 1, wherein said aqueous electrolyte solution comprises a concentration of calcium ions such that the molar ratio of calcium ions to zinc ions is from 0.1:1 to 2:1.

22. (Amended) A process for forming a lubricative film for cold working on a metal substrate, the process comprising the following operations:

- (I) bringing the metal substrate into contact with an aqueous electrolyte solution comprising water and;
 - (A) at least 50 g/l of dissolved zinc cations;
 - (B) dissolved phosphate anions; and
 - (C) at least one dissolved auxiliary acid other than phosphoric acid, the auxiliary acid being present in an amount of at least 30 g/l and having at least a first ionization constant that is greater than the third ionization constant for phosphoric acid; and, optionally, other constituents as detailed further below,

this aqueous electrolyte also being in contact with a counter-electrode that is not the metal substrate to be cold worked, so that an electric current can pass through the counter-electrode as anode, the aqueous electrolyte solution by ionic conduction, and the metal substrate as cathode;

- (II) passing through the metal substrate while it remains in contact with the aqueous electrolyte solution an electric current that has a net cathodizing character at the metal substrate for a sufficient time to form an adherent solid phosphate conversion coating over the metal substrate;
- (III) discontinuing contact between the aqueous electrolyte solution and the metal substrate bearing the adherent solid phosphate conversion coating; and
- (IV) applying to the exterior surface of the solid phosphate conversion coating, when it is not in contact with the aqueous electrolyte solution, a water- or oil-based lubricant coating.

24. (Amended) A process according to claim 23 wherein the aqueous electrolyte solution in operation (I) comprises at least 20 g/l of dissolved phosphate anions.